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Chapter 3

Graphing Linear Functions

Dear Family,

Have you ever thought about how much you might weigh on another planet? Or why you would weigh a different amount on another planet?

What is gravity? How does gravity affect your weight on Earth? Is mass different from weight? If so, how is it different? Use the Internet to research these questions before considering how your weight would change if you visited another planet.

Here is an activity for you to complete as a family to determine how much you would weigh on different planets and on the moon. Upon completing the chart below, graph the information in a coordinate plane.

Given the equation $M = 0.17E$, where M represents an object's weight on the moon and E is an object's weight on Earth, determine how much each member of your family would weigh on the moon. Insert the weight of each member of your family in the chart below, from least to greatest.

$E(x)$						
$M(y)$						

- Is your weight on Earth more or less than your weight on the moon?

Now determine your family's weight on Mercury and Jupiter using the equations below. Complete a chart similar to the one above for each planet. Use a calculator if needed. Graph your weight on the moon, Earth, Mercury, and Jupiter in a coordinate plane, using a different color for each.

- The equation for Mercury is $y = 0.38x$.
- The equation for Jupiter is $y = 2.54x$.

Using your graph, which planet would you weigh the most on? The least? How can you tell?

How about your pet? How much would he or she weigh on the moon? Consider using the equations above to determine the weight of other items if they were on the other planets.

Enjoy exploring outer space together!

Capítulo
3**Hacer gráficas de funciones lineales**

Estimada familia:

¿Alguna vez han pensado cuánto pesarían aproximadamente en otro planeta?

¿O por qué tendrían otro peso en otro planeta?

¿Qué es la gravedad? ¿De qué manera la gravedad afecta sus pesos en la Tierra? ¿La masa es diferente al peso? Si lo es, ¿en qué se diferencia?

Consulten en Internet para investigar sobre estas preguntas antes de considerar cómo cambiarían sus pesos si visitaran otro planeta.

A continuación, encontrarán una actividad para que completen en familia para determinar cuánto pesarían en distintos planetas y en la Luna. Después de completar la siguiente tabla, hagan una gráfica de la información en un plano de coordenadas.

Dada la ecuación $M = 0.17E$, donde M representa el peso de un objeto en la Luna y E es el peso de un objeto en la Tierra, determinen cuánto pesaría cada integrante de la familia en la Luna. Ingresen el peso de cada integrante de su familia en la siguiente tabla, de menor a mayor.

$E(x)$						
$M(y)$						

- ¿Su peso en la Tierra es mayor o menor que su peso en la Luna?

Ahora determinen el peso de su familia en Mercurio y Júpiter usando las siguientes ecuaciones. Completen una tabla similar a la tabla de arriba para cada planeta. Usen una calculadora si la necesitan. Hagan una gráfica de su peso en la Luna, la Tierra, Mercurio y Júpiter en un plano de coordenadas, con un color diferente para cada uno.

- La ecuación para Mercurio es $y = 0.38x$.
- La ecuación para Júpiter es $y = 2.54x$.

Basándose en la gráfica, ¿en qué planeta pesarían más? ¿Menos? ¿Cómo lo saben?

¿Y su mascota? ¿Cuánto pesaría en la Luna? Consideren usar las ecuaciones mencionadas para determinar el peso de otros objetos si estuviesen en otros planetas.

¡Disfruten explorando el espacio exterior juntos!

3.1 Start Thinking

Consider the equation $y = |x|$.

Are there any values of x that you cannot substitute into the equation? If so, what are they? Are there any values of y that you cannot obtain as an answer? If so, what are they?

3.1 Warm Up

In Exercises 1–9, use one coordinate plane to plot the points.

1. $A(4, 2)$
2. $B(-2, 2)$
3. $C(-2, 0)$
4. $D(2, -4)$
5. $E(7, -4)$
6. $F(-6, -10)$
7. $G(10, -7)$
8. $H(-8, -4)$
9. $I(9, 4)$

3.1 Cumulative Review Warm Up

Solve the inequality. Graph the solution.

1. $x + 5 > -6$
2. $7 \leq m + 0$
3. $r - 5 > 4$
4. $10 - w < 6$
5. $h + 3 \leq 9$
6. $j - 10 + 2 > 9$
7. $9 \leq 4p + p + 8$
8. $n - 9 < 10$

3.1 Practice A

In Exercises 1 and 2, determine whether the relation is a function. Explain.

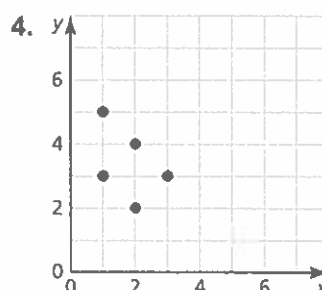
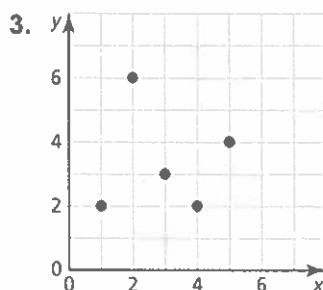
1.

Input, x	8	4	2	4	8
Output, y	-4	-2	0	2	4

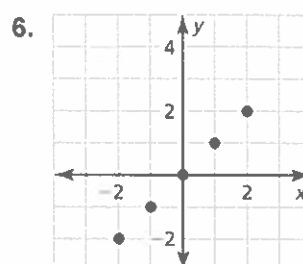
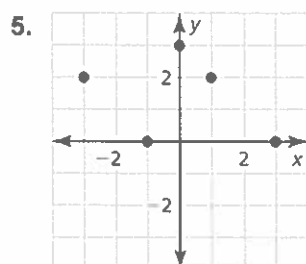
2.

Input, x	0	2	4	6	8
Output, y	3	7	11	15	19

In Exercises 3 and 4, determine whether the graph represents a function. Explain.



In Exercises 5 and 6, find the domain and range of the function represented by the graph.



7. The function $y = 7x + 35$ represents the monthly cost y (in dollars) of a group of x members joining the fitness club.
- Identify the independent and dependent variables.
 - Your group has enough money for up to six members to join the fitness club. Find the domain and range of the function.

In Exercises 8 and 9, determine whether the statement uses the word *function* in a way that is mathematically correct. Explain your reasoning.

- A function pairs each teacher with 30 students.
- The cost of mailing the package is a function of the weight of the package.

3.1 Practice B

In Exercises 1 and 2, determine whether the relation is a function. Explain.

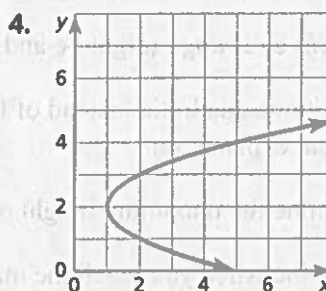
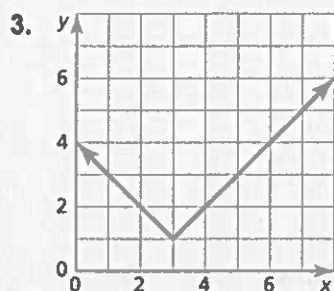
1.

Input, x	0	1	3	2	1
Output, y	1	5	10	15	20

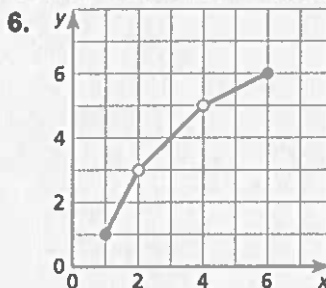
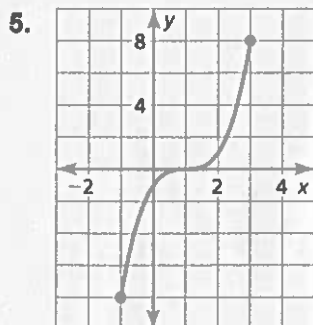
2.

Input, x	0	1	2	3	4
Output, y	-14	-7	0	7	14

In Exercises 3 and 4, determine whether the graph represents a function. Explain.



In Exercises 5 and 6, find the domain and range of the function represented by the graph.



7. The function $2x + 1.5y = 18$ represents the number of book raffle tickets x and food raffle tickets y you buy at a club event.

- Solve the equation for y .
- Make an input-output table to find ordered pairs for the function.
- Plot the ordered pairs in a coordinate plane.

In Exercises 8–10, find the domain and range of the function.

8. $y = |x| + 2$

9. $y = -|x| + 1$

10. $y = -|x| - 3$

3.1 Enrichment and Extension**A Quadratic Function: The Diving Problem**

You are jumping off the 10-foot diving board at the local pool. You bounce up at 6 feet per second and then drop toward the water. Your height h above the water, in terms of time t , follows the function shown.

$$h(t) = -16t^2 + 6t + 10$$

- a. Graph this function, with t on the horizontal axis. Fill in a table of values where the increments of time are tenths of a second.
- b. Explain what the *domain* and *range* might be and why.
- c. Explain why this situation is quadratic instead of linear. Give a graphical explanation and a logical explanation.
- d. Use the graph to determine the maximum height of your dive.
- e. Use the graph to determine when you reach the maximum height of your dive.
- f. Use the graph to determine how long it takes you to hit the water.
- g. Use the *quadratic formula* to prove your answer in part (f).

3.1 Puzzle Time

What Has A Foot On Each End And One In The Middle?

Write the letter of each answer in the box containing the exercise number.

Determine whether the relation is a function.

1. $(8, 5), (6, -2), (4, -9), (2, -6), (4, 7)$

H. yes

I. no

2. $(2, -3), (3, 2), (4, 7), (5, 14), (6, 23)$

A. yes

B. no

3. $(-11, 2), (-9, 2), (-7, 3), (-5, 3), (-3, 3)$

A. yes

B. no

4. $(1, -4), (2, 1), (3, 4), (3, 3), (4, 2)$

B. yes

C. no

5. $(17, -3), (2, -2), (1, 1), (2, 2), (17, 3)$

C. yes

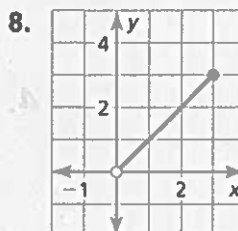
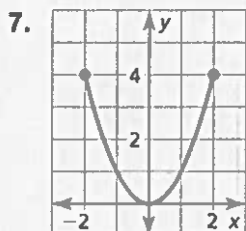
D. no

6. $(-4, 12), (1, 6), (4, -2), (7, -8), (10, -14)$

K. yes

L. no

Find the domain and range of the function represented by the graph.



S. $D: 0 \leq x \leq 4$

$R: -2 \leq y \leq 2$

T. $D: -2 \leq x \leq 2$

$R: 0 \leq y \leq 4$

Q. $D: 0 \leq x \leq 3$

$R: 0 \leq y \leq 3$

R. $D: 0 < x \leq 3$

$R: 0 < y \leq 3$

Use the following information to answer Exercises 9 and 10. The function $t = -8j + 24$ represents the number of tomatoes t that your neighbor has left after making j jars of homemade salsa.

9. Identify the dependent variable.

R. jars of salsa

10. Identify the independent variable.

S. tomatoes

Y. jars of salsa

Z. tomatoes

3		10	2	8	5	9	7	1	4	6
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3.2 Start Thinking

Plot the following points in a coordinate plane.

$(-5, 2)$, $(-4, 0)$, $(-3, -2)$, $(-2, -4)$

Connect the points with a line. Name another point on the line.

Is the point $(1, -2)$ on the line? How do you know? If $(1, -2)$ is part of the relation, is it a function? Why or why not?

3.2 Warm Up

Plot the coordinates from the table in a coordinate plane.

Connect them with a line or smooth curve.

1.

x	1	2	3	4
y	4	8	12	16

2.

x	3	4	5	6
y	2	1	0	-1

3.

x	4	4	4	4
y	2	3	4	5

4.

x	5	6	7	8
y	35	28	29	31

3.2 Cumulative Review Warm Up

Solve the literal equation for x .

1. $y = 5x - 7x$

2. $a = 3x - 5xz$

3. $y = 5x - rx - 5$

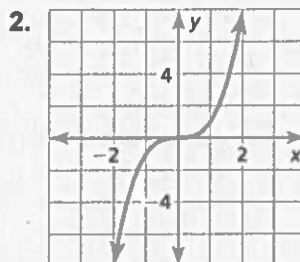
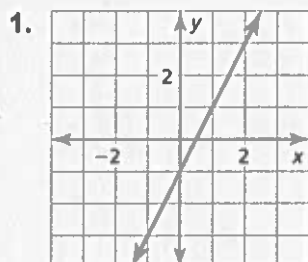
4. $sx - tx = r$

5. $c = 84x - 61$

6. $m = 9x + x$

3.2 Practice A

In Exercises 1 and 2, determine whether the graph represents a **linear** or **nonlinear** function. Explain.



In Exercises 3 and 4, determine whether the table represents a **linear** or **nonlinear** function. Explain.

3.

x	0	1	2	3
y	3	5	7	9

4.

x	1	4	7	10
y	2	5	6	10

In Exercises 5–8, determine whether the equation represents a **linear** or **nonlinear** function. Explain.

5. $y = \sqrt{x} + 5$

6. $y = 4x - 2$

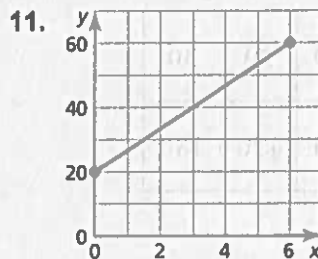
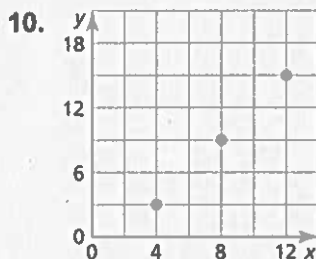
7. $y = 9 - x$

8. $y = (x - 1)(x + 7)$

9. Fill in the table so it represents a linear function.

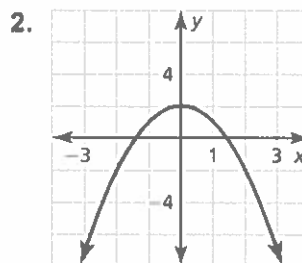
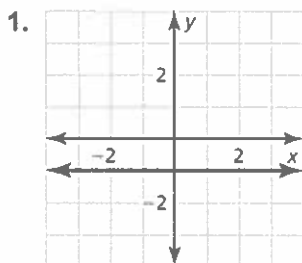
x	4	8	12	16	20
y	-4				12

In Exercises 10 and 11, find the domain of the function represented by the graph. Determine whether the domain is **discrete** or **continuous**. Explain.



3.2 Practice B

In Exercises 1 and 2, determine whether the graph represents a *linear* or *nonlinear* function. Explain.



In Exercises 3 and 4, determine whether the table represents a *linear* or *nonlinear* function. Explain.

3.

x	0	2	4	6
y	3	9	27	81

4.

x	14	24	34	44
y	24	20	16	12

In Exercises 5–8, determine whether the equation represents a *linear* or *nonlinear* function. Explain.

5. $y - \frac{1}{3}x = 4x - 7$

6. $6 - \frac{2}{5}x = 3y + 8x$

7. $(y + 2)(y - 4) = 3x$

8. $4x - 5y + 2xy = 0$

In Exercises 9 and 10, determine whether the domain is *discrete* or *continuous*. Explain.

9.

Input Months, x	1	2	3
Output Height of basil plant (inches), y	3	7	11

10.

Input Tickets, x	10	20	30
Output Cost (dollars), y	60	120	180

3.2 Enrichment and Extension

Linear Functions: Taking a Taxi

You take a trip to downtown Boston to walk the Freedom Trail with your family. After you walk through the Bunker Hill Memorial, your family decides to take a taxi to a restaurant for dinner. After 1 mile, the meter on the taxi says \$4.75. It will cost \$8.25 to go 3 miles. The cost varies linearly with the distance that you traveled.

- Write the particular linear function that models the cost of your trip as a function of the distance traveled. Use the notation $C(d)$.
- Write the function using improper fractions.
- How much would it cost you to travel 10 miles in a taxi?
- How far can you travel if you only have \$10 to spend?
- Calculate the cost-intercept. What does this number represent?
- Plot the graph of this linear function. What is a suitable domain for this problem? What is a suitable range?
- What is the slope of the line? Show how to find it both graphically and algebraically.
- What does the slope of the line represent?
- Write your own linear function word problem, and prove that it works graphically and algebraically.

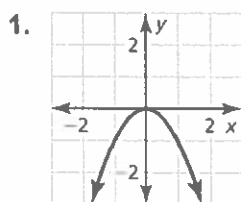
3	2	1	0	-1	-2	-3	-4	-5	-6	-7	-8	-9	-10	-11	-12	-13	-14	-15	-16	-17	-18	-19	-20
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3.2 Puzzle Time

What Do You Get When You Cross A Tortoise And A Porcupine?

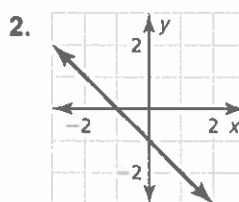
Write the letter of each answer in the box containing the exercise number.

Determine whether the graph, table, or equation represents a linear or nonlinear function.



D. linear

E. nonlinear



O. linear

P. nonlinear

3.

x	2	4	6	8
y	21	18	15	12

A. linear

B. nonlinear

4.

x	-13	-9	-5	-1
y	27	30	27	22

N. linear

O. nonlinear

5. $y = \frac{1}{7}(x - 28) + 16$

W. linear

X. nonlinear

6. $y = -2x^2 + 7$

K. linear

L. nonlinear

7. $y = 14 - \frac{1}{5}x$

P. linear

Q. nonlinear

8. $3 - \frac{1}{9}y = 8x - 11$

K. linear

L. nonlinear

9. The function $y = 16 + 0.75x$ represents the cost y (in dollars) of a large pizza with x extra toppings.

S. linear

T. nonlinear

3		9	6	2	5	7	4	8	1
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3.3 Start Thinking

The range (y) of a function is the result of performing one or more operations on all possible domain (x) values. In the equation $y = -4x + 13$, the input (x) is multiplied by -4 and then added to 13. The value of y depends on the value of x . What is the function of the x -values -4 , 0 , 1 , and 3 in the equation?

Make up a new function and describe how to find the y -values.

3.3 Warm Up

Evaluate the expression for $x = -12$, 0 , and 3 .

1. $-x - 3$

2. $2x + 2$

3. $3x^2 - (2x - x^3)$

4. $x^2(3x - 5) + x$

5. $8x - x$

6. $x + 6x(2x + 3x) \div 4$

3.3 Cumulative Review Warm Up

Solve the inequality.

1. $5 + m < 8 + 2m$

2. $-d + 1 > 4d - 7$

3. $9g + 4g + 5 \geq -4 - 4g$

4. $2 - \frac{m}{2} \geq 7$

5. $4 - \frac{r}{-5} \geq 7$

6. $19 \geq 2(b + 5)$

3.3 Practice A

In Exercises 1–3, evaluate the function when $x = -2$, 0 , and 5 .

1. $f(x) = x - 3$

2. $g(x) = -2x$

3. $h(x) = 5 - 3x$

4. Let $c(t)$ be the number of customers in a department store t hours after 8 A.M.

Explain the meaning of each statement.

a. $c(0) = 10$

b. $c(6) = c(7)$

c. $c(k) = 0$

d. $c(4) > c(3)$

In Exercises 5–8, find the value of x so that the function has the given value.

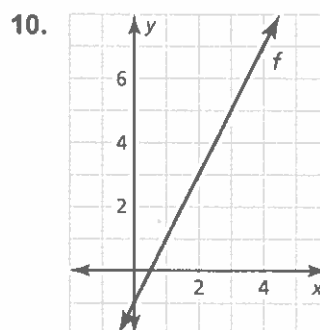
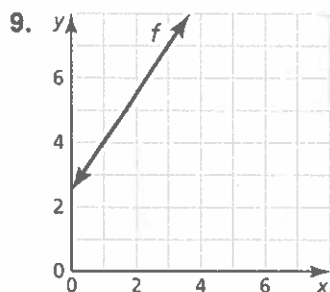
5. $f(x) = 6x$; $f(x) = -24$

6. $g(x) = -10x$; $g(x) = 15$

7. $f(x) = 3x - 5$; $f(x) = 4$

8. $h(x) = 14 - 8x$; $h(x) = -2$

In Exercises 9 and 10, find the value of x so that $f(x) = 7$.



11. The function $C(x) = 29x + 54.5$ represents the cost (in dollars) of cable for x months, including the \$54.50 installation fee.

a. How much would you have spent on cable after 6 months?

b. How many months of cable service can you have for \$344.50?

In Exercises 12–15, graph the linear function.

12. $r(x) = 2$

13. $q(x) = -3x$

14. $g(x) = \frac{2}{5}x - 3$

15. $j(x) = -\frac{1}{3}x + 5$

16. Let f be a function. Use each statement to find the coordinates of a point on the graph of f .

a. $f(-2)$ is equal to 7.

b. A solution of the equation $f(t) = 4$ is 2.

3.3 Practice B

In Exercises 1–3, evaluate the function when $x = -2, 0$, and 5 .

1. $f(x) = 1.5x + 1$ 2. $g(x) = 11 - 3x + 2$ 3. $h(x) = -3 - x - 2$

4. Let $g(x)$ be the percent of your friends with a landline phone x years after 2000.

Explain the meaning of each statement.

a. $g(0) = 100$

b. $g(5) = g(6)$

c. $g(10) = m$

d. $g(11) > g(12)$

In Exercises 5–8, find the value of x so that the function has the given value.

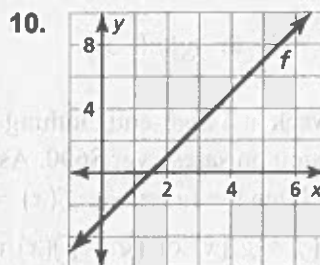
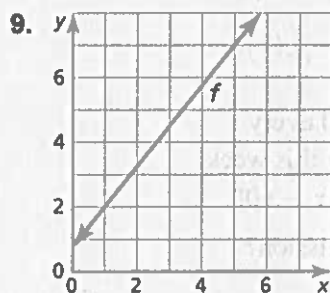
5. $f(x) = 8x - 7; f(x) = 17$

6. $g(x) = -4x + 7; g(x) = 27$

7. $f(x) = \frac{1}{3}x - 1; f(x) = 9$

8. $h(x) = 6 - \frac{2}{3}x; h(x) = -2$

In Exercises 9 and 10, find the value of x so that $f(x) = 7$.



In Exercises 11–14, graph the linear function.

11. $h(x) = -\frac{3}{2}x + 4$

12. $p(x) = \frac{1}{4}x - 1$

13. $v(x) = -5 + 2x$

14. $k(x) = 4 - 3x$

15. The function $C(x) = 35x + 75$ represents the labor cost (in dollars) for Bob's

Auto Repair to replace your alternator, where x is the number of hours. The table shows sample labor costs from its main competitor, Budget Auto Repair. The alternator is estimated to take 5 hours of labor. Which company would you hire?

Explain.

Hours	1	2	3
Cost	\$90	\$130	\$170

3.3 Enrichment and Extension

Composition of Functions

Function Composition, $f(g(x))$ or $(f \circ g)(x)$, is applying the results of one function to the results of another. To perform a composition, you must combine the functions so that the output of one function becomes the input of another.

Example: If $f(x) = -x - 3$ and $g(x) = 2x + 7$, find $f(g(x))$ and $g(f(x))$.

$$f(g(x)) = -(2x + 7) - 3$$

$$g(f(x)) = 2(-x - 3) + 7$$

$$f(g(x)) = -2x - 7 - 3$$

$$g(f(x)) = -2x - 6 + 7$$

$$f(g(x)) = -2x - 10$$

$$g(f(x)) = -2x + 1$$

In Exercises 1–6, perform the indicated operation if $g(x) = 3x + 1$, $h(x) = -4x - 5$, and $p(x) = x^2$.

1. $h(g(x))$

2. $(g \circ g)(x)$

3. $h(g(p(x)))$

4. $h(x) + g(x)$

5. $g(p(-5))$

6. $h(x) - g(x)$

7. You work 40 hours a week at a high-end clothing store. You make \$180 every week plus 3% commission on sales over \$600. Assume you sell enough this week to earn a commission. Given the functions $f(x) = 0.03x$ and $g(x) = x - 600$, which composition of $(f \circ g)(x)$ or $(g \circ f)(x)$ represents your commission?
8. You make a purchase at a local furniture store, but the furniture you buy is too big to bring home yourself, so you have to have it delivered for a small fee. You pay for your purchase plus the sales tax and the fee. The sales tax is 7% while the fee is \$40.
- Write a function $p(x)$ for the total purchase, including only the delivery fee.
 - Write a function $t(x)$ for the total purchase, including only tax and not the delivery fee.
 - Calculate $(p \circ t)(x)$ and $(t \circ p)(x)$. Then interpret both. Which results in a lower cost?
 - If the furniture store is not allowed to tax the delivery fee, which is the appropriate composition for your situation?

3.3 Puzzle Time

How Does A Bee Get To School?

Circle the letter of each correct answer in the boxes below. The circled letters will spell out the answer to the riddle.

Evaluate the function for the given value of x .

1. $g(x) = x - 7; x = 4$

2. $f(x) = -2x; x = -6$

3. $k(x) = -\frac{3}{4}x - 11; x = -12$

4. $t(x) = 9x + 10; x = -\frac{1}{6}$

5. $g(x) = 15 - \frac{7}{8}x; x = 24$

6. $c(x) = 0.25x - 3; x = 10$

7. $w(x) = 21 - 6x - 13; x = \frac{1}{2}$

8. $p(x) = -\frac{1}{4}(x + 36) - 14; x = -8$

Find the value of x so that the function has the given value.

9. $b(x) = 8x; b(x) = -56$

10. $h(x) = -\frac{5}{6}x; h(x) = 10$

11. $n(x) = 16 - 0.5x; n(x) = 48$

12. $r(x) = \frac{8}{9}x - 17; r(x) = 15$

13. $s(x) = -3\left(x - \frac{2}{3}\right) + 19; s(x) = 0$

14. The local cable company charges \$90 per month for basic cable and \$12 per month for each additional premium cable channel. The function $c(x) = 90 + 12x$ represents the monthly charge (in dollars), where x represents the number of additional premium channels. How many additional premium channels would you have ordered if your bill was \$114 per month?

B	I	V	T	K	T	C	A	J	E	K	I	G	E	O	S
4	5	-10	$\frac{17}{2}$	15	36	3	12	9	0	-21	-4	-13	-7	20	-6
M	T	N	H	S	E	D	B	R	U	F	A	Z	Q	P	Z
13	-0.5	25	2	-9	-2	-1	7	10	-12	-15	-25	-3	1	26	-64

3.4 Start Thinking

Equations are useful because they give you a way to represent what happens to y when the value of x is changed.

Think of a situation you can represent with x and y . Write an equation to show their relationship. For your situation, what does it mean when $x = 0$? When $y = 0$? Explain how thinking of these two instances can help you graph your equation.

3.4 Warm Up

Write a rule to relate the variables in the table.

1.

x	1	2	3	4
y	1	4	9	16

2.

x	0	2	4	6
y	1.5	1.3	1.1	0.9

3.

x	1	2	3	4
y	1	8	27	64

4.

x	1	2	3	4
y	9	15	21	27

3.4 Cumulative Review Warm Up

Solve the equation. Justify each step. Check your solution.

1. $6g = 18$

2. $p \div 6 = 2$

3. $-7r = 63$

4. $\frac{x}{7} = 7$

3.4 Practice A

In Exercises 1–3, graph the linear equation.

1. $x = 4$

2. $y = 3$

3. $x = -3$

In Exercises 4–7, find the x - and y -intercepts of the graph of the linear equation.

4. $2x - 5y = 10$

5. $3x + 4y = 12$

6. $-3x + 5y = -30$

7. $-6x - 4y = 24$

In Exercises 8–13, use intercepts to graph the linear equation. Label the points corresponding to the intercepts.

8. $2x + 4y = 8$

9. $3x + 2y = 12$

10. $-5x + 2y = 20$

11. $-4x + 4y = 20$

12. $-3x + 4y = 16$

13. $-2x + 6y = 24$

14. A dance team has two competitions on the same day. The coaches decide to split the 96-member team, sending some to each competition. Competition A requires four-member dance teams per event, and Competition B requires six-member dance teams per event. The equation $4x + 6y = 96$ models this situation, where x is the number of four-member teams and y is the number of six-member teams.

- Graph the equation. Interpret the intercepts.
- Find four possible solutions in the context of the problem.

15. Describe and correct the error in finding the intercepts of the graph of the equation.

$\times$ $ \begin{aligned} 4x - 9y &= 36 \\ 4x - 9(0) &= 36 \\ 4x &= 36 \\ x &= 9 \end{aligned} $	$ \begin{aligned} 4x - 9y &= 36 \\ 4(0) - 9y &= 36 \\ -9y &= 36 \\ y &= -4 \end{aligned} $
The intercept is at $(9, -4)$.	

16. Write an equation in standard form of a line whose intercepts are fractions. Explain how you know the intercepts are fractions.

3.4 Practice B

In Exercises 1–3, graph the linear equation.

1. $y = 1$

2. $x = -2$

3. $y = 0$

In Exercises 4–7, find the x - and y -intercepts of the graph of the linear equation.

4. $-5x + 7y = -35$

5. $-6x - 9y = 54$

6. $4x - 3y = 1$

7. $x - 5y = 2$

In Exercises 8–13, use intercepts to graph the linear equation. Label the points corresponding to the intercepts.

8. $-6x + 3y = -18$

9. $-3x + 8y = -24$

10. $-x + 4y = 9$

11. $2x - y = 3$

12. $-\frac{1}{3}x + y = -3$

13. $-\frac{3}{2}x + y = 15$

14. Your club is ordering enrollment gifts engraved with your club logo. Key chains cost \$5 each. Wristbands cost \$2 each. You have a budget of \$150 for the gifts. The equation $5x + 2y = 150$ models the total cost, where x is the number of key chains and y is the number of wristbands.

- Graph the equation. Interpret the intercepts.
- Your club decides to order 18 key chains. How many wristbands can you order?

15. Describe and correct the error in finding the intercepts of the graph of the equation.

X	$6x + 9y = 18$	$6x + 9y = 18$
	$6x + 9(0) = 18$	$6(0) + 9y = 18$
	$6x = 18$	$9y = 18$
	$x = 3$	$y = 2$
The x -intercept is at $(0, 3)$, and the y -intercept is at $(2, 0)$.		

16. Write an equation in standard form of a line whose x -intercept is an integer and y -intercept is a fraction. Explain how you know that the x -intercept is an integer and the y -intercept is a fraction.



Puzzle Time

Why Did The Horse Go To The Doctor?

Write the letter of each answer in the box containing the exercise number.

Find the x - and y -intercepts of the graph of the linear equation.

1. $3x + 4y = 24$
2. $-4x - 6y = 12$
3. $x + 9y = 36$
4. $-2x + 5y = -10$
5. $y = 3$
6. $7x - 2y = 28$
7. $-\frac{1}{4}x + 2y = 8$
8. $\frac{1}{6}x - \frac{1}{3}y = 9$
9. $x = -14$
10. $13x - 14y = -26$
11. The student council is responsible for setting up the tables for an awards banquet at the end of the year. The council members need to decide what tables they should use. Eight people can sit at a circular table, while 12 people can sit at a rectangular table. There are 144 people who confirmed that they would attend. The equation $8x + 12y = 144$ models this situation, where x is the number of circular tables and y is the number of rectangular tables. Find the x - and y -intercepts.

9	3	5		11	4	6		8	1	10	2	7
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Answers

- E. x -intercept: $(-3, 0)$;
 y -intercept: $(0, -2)$
- R. x -intercept: $(-32, 0)$;
 y -intercept: $(0, 4)$
- Y. x -intercept: $(4, 0)$;
 y -intercept: $(0, -14)$
- O. x -intercept: $(36, 0)$;
 y -intercept: $(0, 4)$
- F. x -intercept: $(-14, 0)$;
 y -intercept: none
- A. x -intercept: $(5, 0)$;
 y -intercept: $(0, -2)$
- V. x -intercept: $(-2, 0)$;
 y -intercept: $(0, \frac{13}{7})$
- R. x -intercept: none;
 y -intercept: $(0, 3)$
- H. x -intercept: $(18, 0)$;
 y -intercept: $(0, 12)$
- F. x -intercept: $(54, 0)$;
 y -intercept: $(0, -27)$
- E. x -intercept: $(8, 0)$;
 y -intercept: $(0, 6)$

3.5 Start Thinking

Tractor-trailers often weigh in excess of 50,000 pounds. With all the weight on board, these trucks need an extra warning when traveling down steep hills.

Research the term *roadway grade* and explain its importance to tractor-trailer drivers. How would you represent a 13% grade as a fraction when traveling downhill?

3.5 Warm Up

Make a table of points and plot them in a coordinate plane.

Connect the points with a line.

1. $y = -2x - 3$

2. $y = 6x + 6$

3. $-x - 2y = 3$

4. $-4x = 7 + 2y$

5. $y = 5x$

6. $y = 0$

3.5 Cumulative Review Warm Up

Solve the inequality. Graph the solution, if possible.

1. $|x| > 4$

2. $|d - 8| < 4$

3. $|s + 8| \leq 0$

4. $|4p - 3| > -5$

5. $|y| \leq 5.4$

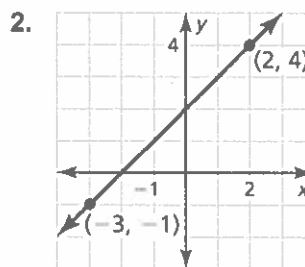
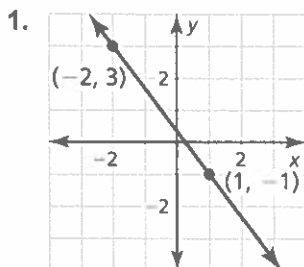
6. $|h + 6| \geq 9$

7. $|5c - 7| < 8$

8. $|8 + 5n| > 12$

3.5 Practice A

In Exercises 1 and 2, describe the slope of the line. Then find the slope.



In Exercises 3 and 4, the points represented by the table lie on a line. Find the slope of the line.

3.

x	-2	1	4	7
y	0	1	2	3

4.

x	0	2	5	7
y	3	3	3	3

In Exercises 5–8, find the slope and the y -intercept of the graph of the linear equation.

5. $y = -6x + 2$

6. $y = 7x$

7. $y = -3$

8. $x - y = 9$

In Exercises 9–12, graph the linear equation. Identify the x -intercept.

9. $y = x + 4$

10. $y = \frac{1}{3}x - 1$

11. $y = -2x$

12. $4x + y = 3$

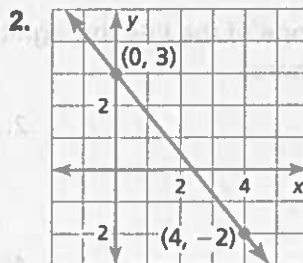
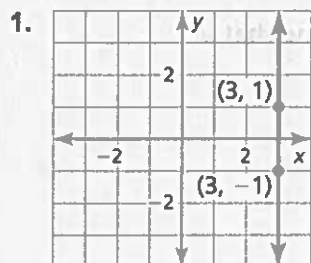
In Exercises 13 and 14, graph the function with the given description. Identify the slope, y -intercept, and x -intercept of the graph.

13. A linear function f models a relationship in which the dependent variable decreases 3 units for every 2 units the independent variable increases. The value of the function at 0 is 5.

14. A linear function g models a relationship in which the dependent variable increases 2 units for every 7 units the independent variable increases. The value of the function at 0 is -1 .

3.5 Practice B

In Exercises 1 and 2, describe the slope of the line. Then find the slope.



In Exercises 3 and 4, the points represented by the table lie on a line. Find the slope of the line.

3.

x	4	4	4	4
y	-2	1	4	7

4.

x	3	1	-1	-3
y	-4	1	6	11

In Exercises 5–8, find the slope and the y -intercept of the graph of the linear equation.

5. $y = 12$

6. $-3x + y = 7$

7. $-4x = 9 - 2y$

8. $0 = 2 - 3y + 12x$

In Exercises 9–12, graph the linear equation. Identify the x -intercept.

9. $y = x$

10. $x + 3y = 9$

11. $-y + 2x = 0$

12. $3x - y + 1 = 0$

13. A linear function g models the growth of your hair. On average, the length of a hair strand increases 1.25 centimeters every month.

a. Graph g when $g(0) = 10$.

b. Identify the slope and interpret the y -intercept of the graph.

c. By how much, in inches, does the length of a hair strand increase each month?

In Exercises 14 and 15, find the value of k so that the graph of the equation has the given slope or y -intercept.

14. $y = 6kx - 2$; $m = \frac{2}{3}$

15. $y = -\frac{1}{2}x + \frac{4}{3}k$; $b = -8$

3.5 Enrichment and Extension**Challenge: Slope and Slope-Intercept Form**

In Exercises 1–4, find the slope of the line through the given points. Assume that a and b are nonzero real numbers.

1. (a, b) and $(-2, 1)$
2. $(2a, 3b)$ and $(-2a, b)$
3. (a, b) and (b, a)
4. $(5a, b)$ and $(-5b, -a)$

Two lines are *parallel* if they both have the same slope. Two lines are *perpendicular* if the product of their slopes is -1 , unless the slopes are 0 and undefined. In Exercises 5–8, find the value of x so that the line through the pair of points is *parallel* to a line with the slope given. Then find the value of x so that the line through the pair of points is *perpendicular* to a line with the slope given.

5. $m = \frac{1}{2}$; $(-3, x)$ and $(1, 4)$
6. $m = 0$; $(x, -3)$ and $(5, x)$
7. $m = -3$; $(3, -2x)$ and $(-4, 5)$
8. $m = \frac{5}{4}$; $(-1, 4)$ and $(x, -2)$



Puzzle Time

What Did The Pelican Say When It Finished Shopping?

Write the letter of each answer in the box containing the exercise number.

Find the slope of the line passing through the given points.

- $(-10, -12), (-8, -8), (-6, -4), (-4, 0)$
- $(-4, 2), (0, 1), (4, 0), (8, -1)$
- $(-7, -7), (0, -8), (7, -9), (14, -10)$
- $(-2, 2), (0, 3), (2, 4), (4, 5)$
- $(2, -11), (4, -25), (6, -39), (8, -53)$
- $(-11, -38), (-5, -14), (1, 10), (7, 34)$

Find the slope and the y-intercept of the graph of the linear equation.

- $y = -4x + 6$
- $y = -\frac{1}{4}$
- $4x + y = -1$
- $y = 6x - 4$
- $-x - 4y + 8 = 0$
- $2x - 12y + 10 = 0$
- The local service center advertises that it charges a flat fee of \$50 plus \$8 per mile to tow a vehicle. The function $C(x) = 8x + 50$ represents the cost C (in dollars) of towing a vehicle, where x is the number of miles the vehicle is towed. Identify the slope and y-intercept.

Answers

I. $m = \frac{1}{2}$

M. $m = 6, b = -4$

U. $m = -\frac{1}{4}$

N. $m = -4, b = -1$

P. $m = -4, b = 6$

I. $m = -7$

L. $m = -\frac{1}{4}, b = 2$

O. $m = 2$

L. $m = 4$

T. $m = 0, b = -\frac{1}{4}$

B. $m = 8, b = 50$

Y. $m = -\frac{1}{7}$

T. $m = \frac{1}{6}, b = \frac{5}{6}$

7	2	12		5	8		1	9		10	3		13	4	11	6
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3.6 Start Thinking

Graph the lines $y = x$ and $y = 5x$. Note the change in slope of the line. Graph the line $y = 20x$. What is happening to the line?

What would the line look like if the slope was changed to 100? 1000? What if the slope was the greatest number you can think of? Explain how this shows the slope of a vertical line is *undefined*.

3.6 Warm Up

Graph the point and its image in a coordinate plane.

1. $P(-5, 3)$; reflected in the y -axis
2. $Q(-4, -3)$; reflected in the x -axis
3. $R(-1, -5)$; reflected in the line through $(-2, 2)$ and $(-2, 3)$
4. $S(5, 1)$; reflected in the line through $(3, -3)$ and $(8, -3)$

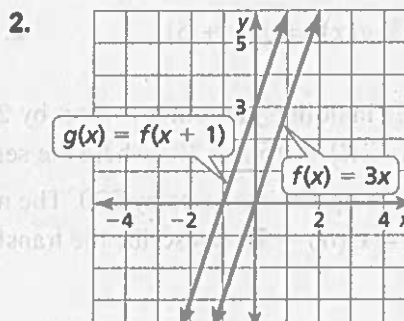
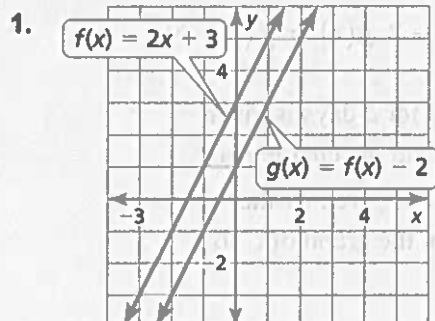
3.6 Cumulative Review Warm Up

Solve the equation.

- | | |
|---------------------------|--------------------------|
| 1. $4c - 2 = 2c$ | 2. $3(7q + 6) = 3q$ |
| 3. $5(-g - 10) = 6 - 13g$ | 4. $m + 4 = 12$ |
| 5. $5 = 6w - 9w - 1$ | 6. $3k + 2(3k + 2) = 49$ |

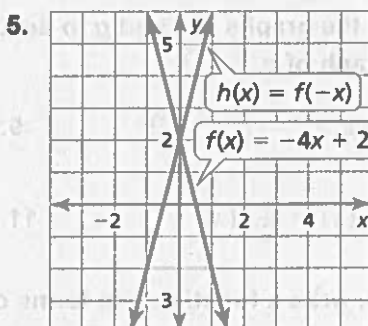
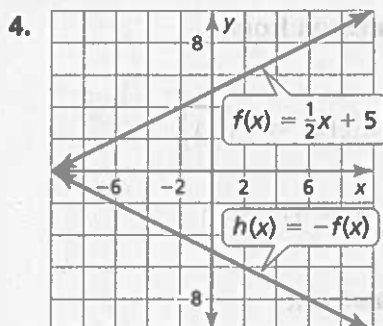
3.6 Practice A

In Exercises 1 and 2, use the graphs of f and g to describe the transformation from the graph of f to the graph of g .



3. You and a friend start running from the same location. Your distance d (in miles) after t minutes is $d(t) = \frac{1}{7}t$. Your friend starts running 10 minutes after you. Your friend's distance f is given by the function $f(t) = d(t - 10)$. Describe the transformation from the graph of d to the graph of f .

In Exercises 4 and 5, use the graphs of f and h to describe the transformation from the graph of f to the graph of h .



In Exercises 6 and 7, use the graphs of f and r to describe the transformation from the graph of f to the graph of r .

6. $f(x) = x + 2$; $r(x) = f(3x)$

7. $f(x) = 3x + 6$; $r(x) = \frac{1}{3}f(x)$

In Exercises 8 and 9, write a function g in terms of f so that the statement is true.

8. The graph of g is a vertical translation 3 units down of the graph of f .
9. The graph of g is a reflection in the x -axis of the graph of f .

3.6 Practice B

In Exercises 1 and 2, use the graphs of f and g to describe the transformation from the graph of f to the graph of g .

1. $f(x) = -x - 3$; $g(x) = f(x + 5)$ 2. $f(x) = \frac{1}{3}x - 2$; $g(x) = f(x - 6)$

3. The total cost C (in dollars) to rent a 14-foot by 20-foot canopy for d days is given by the function $C(d) = 15d + 30$, where the setup fee is \$30 and the charge per day is \$15. The setup fee increases by \$20. The new total cost T is given by the function $T(d) = C(d) + 20$. Describe the transformation from the graph of C to the graph of T .

In Exercises 4 and 5, use the graphs of f and h to describe the transformation from the graph of f to the graph of h .

4. $f(x) = -3 - x$; $h(x) = f(-x)$ 5. $f(x) = \frac{1}{3}x + 1$; $h(x) = -f(x)$

In Exercises 6 and 7, use the graphs of f and r to describe the transformation from the graph of f to the graph of r .

6. $f(x) = 5x - 10$; $r(x) = f\left(\frac{2}{5}x\right)$ 7. $f(x) = -\frac{1}{3}x + 2$; $r(x) = 6f(x)$

In Exercises 8–11, use the graphs of f and g to describe the transformation from the graph of f to the graph of g .

8. $f(x) = -3x + 5$; $g(x) = f(x - 3)$ 9. $f(x) = -2x + 6$; $g(x) = f\left(\frac{4}{3}x\right)$

10. $f(x) = 4x - 3$; $g(x) = \frac{1}{2}f(x)$ 11. $f(x) = -2x$; $g(x) = f(x) + 3$

In Exercises 12 and 13, write a function g in terms of f so that the statement is true.

12. The graph of g is a horizontal shrink by a factor of $\frac{2}{3}$ of the graph of f .

13. The graph of g is a horizontal translation 5 units left of the graph of f .

In Exercises 14–17, graph f and h . Describe the transformations from the graph of f to the graph of h .

14. $f(x) = x$; $h(x) = -2x + 1$ 15. $f(x) = x$; $h(x) = \frac{3}{2}x + 2$

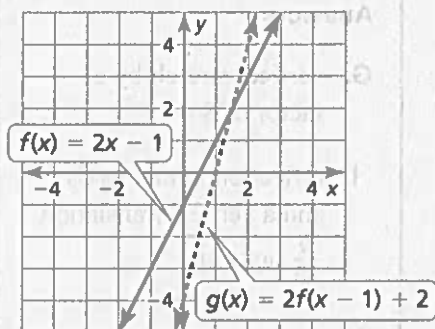
16. $f(x) = 2x$; $h(x) = 8x - 3$ 17. $f(x) = 3x$; $h(x) = -3x - 5$

3.6 Enrichment and Extension

Multiple Transformations of Linear Equations

Example: Let $f(x) = 2x - 1$. Graph the transformation $g(x) = 2f(x - 1) + 2$.

Use composition of functions to rewrite $g(x)$. Then find $g(-1)$, $g(0)$, and $g(1)$ to check your graph.



$$g(x) = 2(2(x - 1) - 1) + 2 \quad g(-1) = -8$$

$$g(x) = 2(2x - 3) + 2 \quad g(0) = -4$$

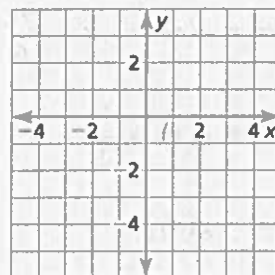
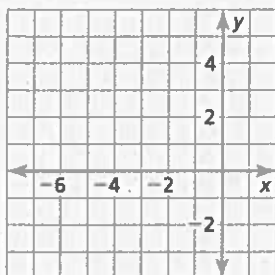
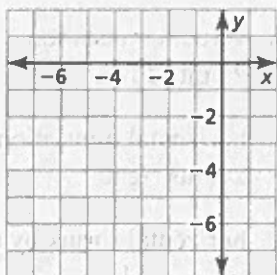
$$g(x) = 4x - 4 \quad g(1) = 0$$

Let $f(x) = 3x + 2$. Graph each transformation given. Use composition of functions to rewrite $g(x)$. Then find $g(-2)$, $g(0)$, and $g(1)$.

1. $g(x) = -f\left(\frac{1}{3}x\right) - 4$

2. $g(x) = \frac{1}{5}f(x + 3) + 2$

3. $g(x) = f(2x - 1) - 3$



4. What is different about Exercise 3? Is it possible to write a rule for this type of transformation? If so, please demonstrate.

1	2	3	4	5	6	7	8	9	10	11	12

3.6 Puzzle Time

What Did One Watch Say To The Other Watch?

Write the letter of each answer in the box containing the exercise number.

Describe the transformations from the graph of f to the graph of g .

1. $f(x) = x - 7$; $g(x) = f(x - 2)$
2. $f(x) = \frac{3}{5}x + 9$; $g(x) = f(-x)$
3. $f(x) = -6x - 11$; $g(x) = f\left(\frac{1}{4}x\right)$
4. $f(x) = \frac{2}{3}x - 18$; $g(x) = f(x) - 2$
5. $f(x) = -10x + 21$; $g(x) = 8f(x)$
6. $f(x) = x$; $g(x) = x + 6$
7. $f(x) = x$; $g(x) = -x + \frac{9}{16}$
8. $f(x) = x$; $g(x) = \frac{1}{2}x - 6$
9. $f(x) = x$; $g(x) = 4x - 3$
10. Members of the marching band need to rent a moving van to haul their instruments back and forth to several competitions. The total cost C (in dollars) to rent a moving van for m miles is given by the function $C(m) = 4m + 225$, where the flat fee is \$225 and the charge per mile is \$4. The flat fee decreases by \$5. The new total cost T is given by the function $T(m) = C(m) - 5$. Describe the transformation from the graph of C to the graph of T .

Answers

- G.** vertical stretch by a factor of 8
- I.** reflection in the x -axis and a vertical translation $\frac{9}{16}$ units up
- A.** reflection in the y -axis
- T.** horizontal stretch by a factor of 2 and a vertical translation 6 units down
- N.** vertical translation 5 units down
- U.** vertical translation 2 units down
- E.** horizontal translation 2 units right
- M.** horizontal shrink by a factor of $\frac{1}{4}$ and a vertical translation 3 units down
- T.** vertical translation 6 units up
- O.** horizontal stretch by a factor of 4

5	3	8		2		9	7	10	4	6	1
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3.7 Start Thinking

Use a graphing calculator to graph the function $f(x) = |x|$.

Sketch the graph on a coordinate plane. Describe the graph of the function.

Now graph the functions $g(x) = |x + 5|$, and $h(x) = |x| + 5$ on the same coordinate plane. Explain why the graphs of $g(x)$ and $h(x)$ are not the same.

3.7 Warm Up

Solve the equation, if possible.

1. $|n - 8| = 4$

2. $|b - 5| = 1$

3. $|4z + 2| = 10$

4. $|t + 5| = 7$

5. $|5n| = -5$

6. $|6h - 1| = -7$

7. $|2n + 2| = 6$

8. $|5t + 7| = 22$

3.7 Cumulative Review Warm Up

Write the sentence as an inequality. Then solve the inequality.

1. A number minus 7 is less than 12.

2. A number plus 2 is at most -4 .

3. The sum of a number and 8 is greater than 5.

4. The number 5 is greater than or equal to the difference of a number and 16.

3.7 Practice A

In Exercises 1–4, graph the function. Compare the graph to the graph of $f(x) = |x|$. Describe the domain and range.

1. $g(x) = |x| - 2$

2. $p(x) = |x| + 1$

3. $h(x) = |x + 5|$

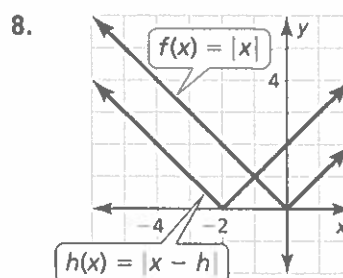
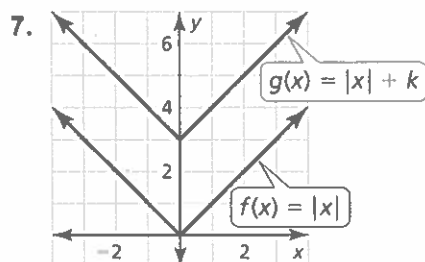
4. $k(x) = \frac{1}{2}|x|$

In Exercises 5 and 6, graph the function. Compare the graph to the graph of $f(x) = |x + 4|$.

5. $h(x) = |x + 4| - 4$

6. $h(x) = 2|x + 4|$

In Exercises 7 and 8, compare the graphs. Find the value of h , k , or a .



In Exercises 9 and 10, write an equation for $h(x)$ that represents the given transformation(s) of the graph of $g(x) = |x|$.

9. vertical translation 4 units up

10. vertical stretch by a factor of 3

In Exercises 11 and 12, graph and compare the two functions.

11. $f(x) = |x - 3|$; $g(x) = |2x - 3|$

12. $m(x) = |x + 2| - 5$; $n(x) = \left|\frac{1}{2}x + 2\right| - 5$

13. The number of ice cream cones sold c (in hundreds) increases and then decreases as described by the function $c(t) = -5|t - 6| + 40$, where t is the time (in months).

a. Graph the function.

b. What is the greatest number of ice cream cones sold in 1 month?

3.7 Practice B

In Exercises 1–4, graph the function. Compare the graph to the graph of $f(x) = |x|$. Describe the domain and range.

1. $m(x) = |x - 3|$

2. $t(x) = 4|x|$

3. $g(x) = -3|x|$

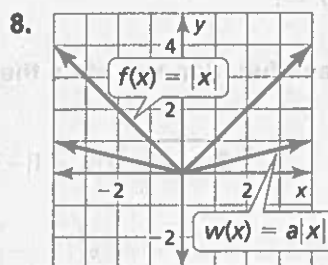
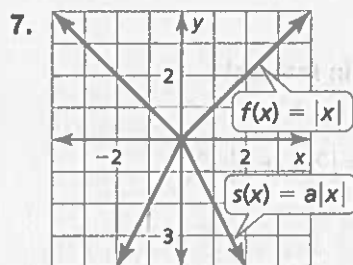
4. $z(x) = -\frac{4}{3}|x|$

In Exercises 5 and 6, graph the function. Compare the graph to the graph of $f(x) = |x - 2| + 4$.

5. $k(x) = |x - 5| + 4$

6. $q(x) = |x - 2| - 3$

In Exercises 7 and 8, compare the graphs. Find the value of h , k , or a .



In Exercises 9 and 10, write an equation for $h(x)$ that represents the given transformation(s) of the graph of $g(x) = |x|$.

9. horizontal translation 7 units right

10. vertical shrink by a factor of $\frac{1}{3}$ and a reflection in the x -axis

In Exercises 11 and 12, graph and compare the two functions.

11. $c(x) = |x - 4| + 3$; $d(x) = |6x - 4| + 3$

12. $p(x) = |x + 1| - 2$; $q(x) = \left| -\frac{2}{5}x + 1 \right| - 2$

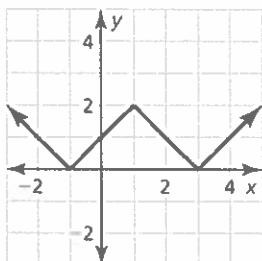
13. Graph $y = -\frac{3}{2}|x + 3| - 5$ and $y = -8$ in the same coordinate plane.

Use the graph to solve the equation $-\frac{3}{2}|x + 3| - 5 = -8$. Check your solutions.

3.7 Enrichment and Extension

Transformations and Compositions

Example: Graph $y = -|x - 1| + 2$, and then state the domain and range in interval notation.

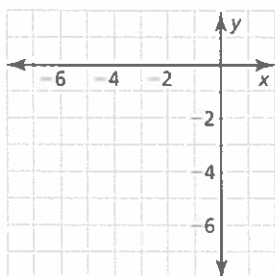


First graph the function on the inside of the outer absolute value. Then invert all the negative y -values to positive y -values, because the final output of this particular absolute value function must be all positive numbers.

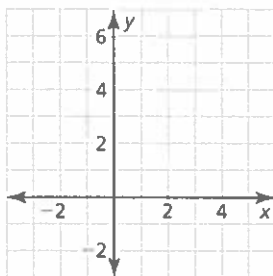
domain: $(-\infty, \infty)$ range: $[0, \infty)$

In Exercises 1–6, graph each function and state the domain and range in interval notation.

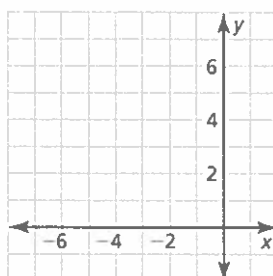
1. $y = |-x - 3| - 4$



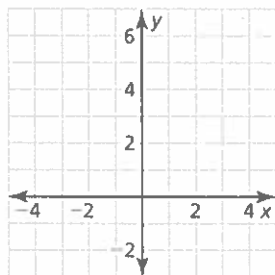
2. $y = |2|x - 1| - 3|$



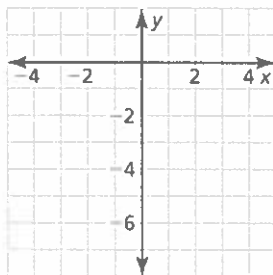
3. $y = |2|x + 3| - 2|$



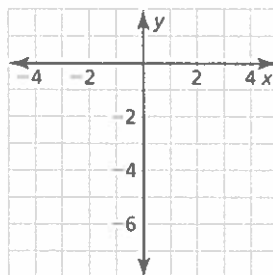
4. $y = -|-x|$



5. $y = -|-2|-x|$



6. $y = -|3|x| - 1|$



3.7 Puzzle Time

What Do Sharks Eat For Dinner?

Write the letter of each answer in the box containing the exercise number.

Describe the transformations from the graph of f to the graph of g .

- $f(x) = |x|$; $g(x) = |x| + 6$
- $f(x) = |x|$; $g(x) = |x - 3|$
- $f(x) = |x|$; $g(x) = |-x|$
- $f(x) = |x|$; $g(x) = \frac{1}{4}|x|$
- $f(x) = |x - 7|$; $g(x) = -3|x - 7|$
- $f(x) = |x + 1|$; $g(x) = |x - 2| + 8$
- $f(x) = |x + 9| - 6$; $g(x) = |x + 7| - 10$
- $f(x) = |x - 11| + 8$; $g(x) = |4x - 11| + 8$

Write an equation that represents the given transformation(s) of the graph of $f(x) = |x|$.

- horizontal translation 3 units left and a reflection in the x -axis
- vertical stretch by a factor of 3 and a reflection in the y -axis
- a reflection in the x -axis and a vertical translation 3 units up
- horizontal shrink by a factor of $\frac{1}{3}$ and a vertical translation 3 units down

Answers

- $g(x) = -|x| + 3$
- reflection in the y -axis
- horizontal translation 3 units right and vertical translation 8 units up
- reflection in the x -axis and a vertical stretch by a factor of 3
- vertical shrink by a factor of $\frac{1}{4}$
- horizontal translation 2 units right and vertical translation 4 units down
- vertical translation 6 units up
- $g(x) = -|x + 3|$
- $g(x) = 3|-x|$
- $g(x) = |3x| - 3$
- horizontal translation 3 units right
- horizontal shrink by a factor of $\frac{1}{4}$

6	12	2	9		1	5	4		10	7	11	3	8
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**Chapter
3****Cumulative Review**

Solve the equation and check your answer.

1. $x + 3 = 40$

2. $9b = -72$

3. $\frac{y}{7} = 21$

4. $h + \frac{7}{13} = \frac{7}{13}$

5. $j - 9\pi = 12\pi$

6. $w \div (-0.5) = -2$

7. $-6x - 5 = 37$

8. $39 = 17u - 4u$

9. $\frac{z-1}{3} = 20$

Write and solve an equation to answer the question.

10. It costs \$513 for you and your two friends to go skiing for the weekend. How much does it cost for just you to go skiing for the weekend?
11. Your four-month bill for the gym comes to \$221. That includes the cost per month of \$50 plus the one-time membership fee. How much is the membership fee?

Solve the equation. Check your solution.

12. $2(2r - 4) = -52$

13. $x + 2(2x + 5) = 4(x + 3)$

14. $2y + 2(2y - 3) = -4y + 8(y - 5)$

15. $\frac{1}{2}(8z + 40) = \frac{1}{6}(18z + 126)$

16. Your cell phone company offers you a choice between two promotional deals. You can either get 500 free text messages with a charge of \$0.10 for each text message over 500, or you can get 400 free text messages with a charge of \$0.20 for each text message over 400. How many text messages would you have to send for the cost to be the same for either plan?

Solve the equation. Determine whether the equation has *one solution*, *no solution*, or *infinitely many solutions*.

17. $y - 10 = y + 3 - 13$

18. $15v - 60 = -3(20 - 5v)$

19. $3(4x - 2) = 4(3x - 1) + x$

Solve the equation. Graph the solutions, if possible.

20. $|x + 7| = 2$

21. $|3d| = -6$

22. $|3r - 6| = 12$

23. $-2\left|\frac{y-4}{5}\right| = -10$

24. Torque is a measure of how much to tighten a bolt. The torque specification for a small-block Chevy V8 is 70 foot-pounds with an error of 0.02 foot-pounds. Write and solve an absolute value equation to find the minimum and maximum torque required for the bolts.

Chapter 3

Cumulative Review (continued)

Write the sentence as an inequality.

25. A number n is at least 20.

26. The number 50 is no more than a number h times 2.

Solve the inequality. Graph the solution.

27. $b + 2 - 1 \geq 11$

28. $56 - (-t) > -38 + 7$

29. $5 - 7z + 8z < 10 - 2$

Write the sentence as an inequality. Then solve the inequality.

30. The difference of 5 and a number is at least 13.

31. A number plus 14 is no more than 2.

Solve the inequality. Graph the solution, if possible.

32. $8w + 7 < 3w - 3$

33. $4(g - 2) > 4g$

34. $7(h - 1) \geq -7(8 - h)$

35. $-3 < 9 + 2n < 23$

36. $5w > 25$ and $7w \leq 42$

37. $2t + 7 \geq 27$ or $3 + 3t \leq 30$

Solve the inequality. Graph the solution, if possible.

38. $|2x - 77| < -55$

39. $|3w - 5| + 6 \geq 10$

40. $|5 + 10x| < 25$

Determine whether the relation is a function. Explain.

41. $(2, 3), (4, 5), (-4, 7), (2, 8), (9, 10)$

42. $(-5, 2), (-3, 8), (0, 1), (3, 7), (5, 11)$

43. $(4, 3), (7, 3), (9, 3), (-2, 3), (3, 3)$

44. $(1, 4), (7, -11), (0, -22), (1, 8), (-1, 67)$

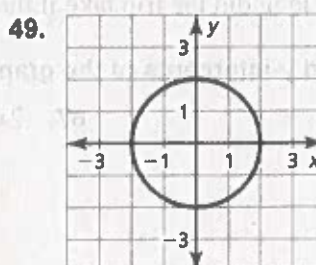
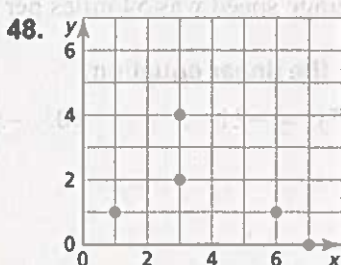
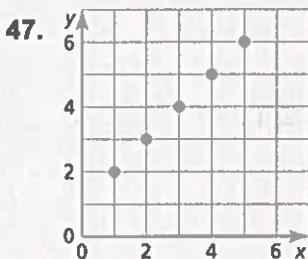
45.

x	0	1	2	3
y	-2	0	2	4

46.

Input	-2	0	2	-2
Output	10	7	4	1

Find the domain and range of each relation, and determine whether or not the graph represents a function.



Chapter

3

Cumulative Review (continued)

50. The function $y = -3x + 44$ represents the amount of money left in your school lunch account y (in dollars) after x days.

- Identify the independent and dependent variables.
- There are 10 days left in the school year. Find the domain and range of the functions.

Determine whether the table represents a *linear* or *nonlinear* function. Explain.

51.

x	0	1	2	3
y	7	11	15	19

52.

Input	2	4	6	8
Output	1	2	8	16

Determine whether the equation represents a *linear* or *nonlinear* function. Explain.

53. $y = x^4 - 2$

54. $2x + 3y = 5$

55. $y = 2x(2 - x)$

Evaluate the function when $x = -3, 0$, and 4 .

56. $f(x) = x - 5$

57. $g(x) = -5x + 7$

58. $h(x) = 3 - 2x - 12$

Find the value of x so that the function has the given value.

59. $f(x) = 4x; f(x) = -32$

60. $r(x) = \frac{1}{3}x + 2; r(x) = 4$

61. $q(x) = 2x + 1; q(x) = 17$

Graph the linear function.

62. $f(x) = 2x$

63. $w(x) = \frac{1}{3}x - 2$

64. $h(x) = 4 - 7x$

65. The function $f(x) = \frac{108}{x}, x \neq 0$ represents the average speed of a car that took a 108-mile trip in x hours.

- What was the average speed of the car if the trip took 3 hours?
- How long did the trip take if the average speed was 54 miles per hour?

Find the x - and y -intercepts of the graph of the linear equation.

66. $2x + 4y = 8$

67. $2x - 7y = -21$

68. $-x + 3y = 13$

**Chapter
3****Cumulative Review (continued)**

Use intercepts to graph the linear equation. Label the points corresponding to the intercepts.

69. $-\frac{2}{3}x + y = 4$

70. $-2x + 2y = 10$

71. $4x - 3y = -7$

72. You are ordering warm-up clothes for the basketball team. The mesh shirts cost \$16 each and the cotton shirts cost \$8 each. You have a budget of \$240 for the shirts. The equation $16x + 8y = 240$ models the total cost, where x is the number of mesh shirts and y is the number of cotton shirts.

- Graph the equation. Interpret the intercepts.
- Four players decide they want the cotton shirts. How many mesh shirts can you order?

The following points lie on a line. Find the slope of the line.

73. $(1, 3), (2, 6), (3, 9), (4, 12), (5, 15)$

74. $(-2, -2), (0, 2), (2, 6), (4, 10), (6, 14)$

Find the slope and y -intercept. Then graph the linear equation.

75. $y = \frac{1}{3}x - 2$

76. $y = -3x$

77. $4x - 2y = 8$

Use the graphs of f and g to describe the transformation from the graph of f to the graph of g .

78. $f(x) = 3x - 1; g(x) = \frac{1}{3}x - 1$

79. $f(x) = 2x + 4; g(x) = 2x - 4$

Write a function g in terms of f so that the statement is true.

80. The graph of g is a vertical stretch by a factor of 3 of the graph of f .

81. The graph of g is a horizontal translation 4 units right of the graph of f .

Graph the function. Compare the graph to the graph of $f(x) = |x|$. Describe the domain and range.

82. $t(x) = |x| + 1$

83. $r(x) = |x - 3|$

84. $h(x) = -\frac{1}{4}|x|$

Graph and compare the two functions.

85. $f(x) = |x + 2|; g(x) = |2x + 2|$

86. $h(x) = |x - 1| - 2; t(x) = |3x - 1| - 2$